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Oliver

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(54) **TWO-STAGED TOILED TANK BOWL CONTROL SYSTEM**

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E03D 1/14 (2006.01)
E03D 3/12 (2006.01)

(52) **U.S. Cl.** **4/325**; 4/407; 4/410

(58) **Field of Classification Search** 4/324, 4/325, 405, 407, 410
See application file for complete search history.

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(57) **ABSTRACT**

A two stage toilet tank bowl control system includes a tank ball selectively positioned on the valve seat in the water tank. The tank ball is linked to a lifting lever so as to raise the tank ball from the seat when the lifting lever is rotated in its flushing direction. An air outlet tube communicates with the interior of the tank ball to permit air to be exhausted from the interior of the tank ball. The air tube communicates with a passageway in a air flow block mounted to the wall of the water tank. The passageway has a full flush branch and a partial flush branch. A partial flush valve maintains the partial flush branch closed during conditions of full flush. A full flush handle moves the lifting lever in its flushing direction with the partial flush valve maintained in a closing condition against the outlet of the partial flush branch. A partial flush handle moves the lifting lever in its flushing direction in such a manner as to remove the partial flush valve from the partial flush branch outlet so that air is purged at a greater flow rate from the tank ball under partial flush conditions than under full flush conditions to return the tank ball to its closing position on the valve seat in a shorter period of time than under full flush conditions.

26 Claims, 10 Drawing Sheets

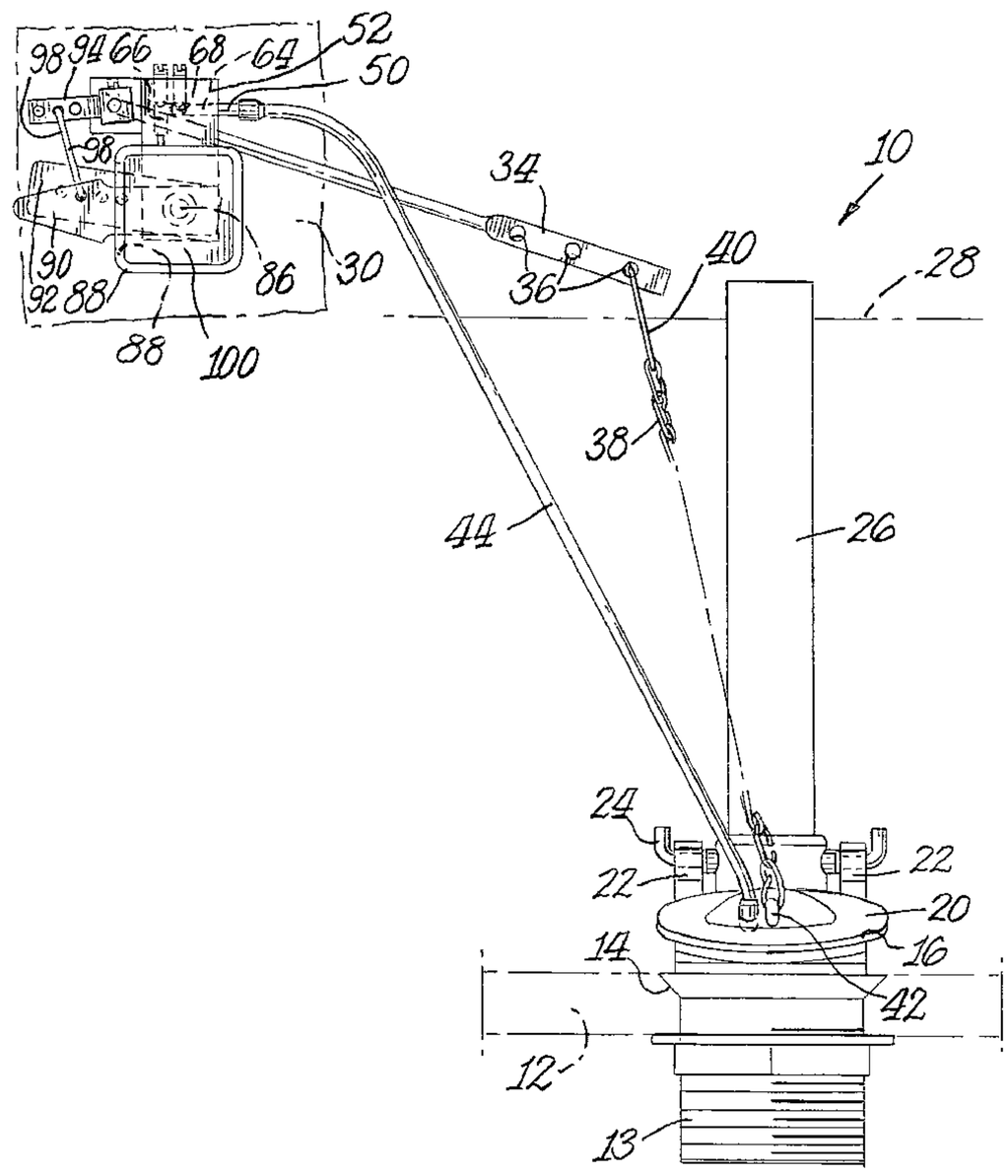
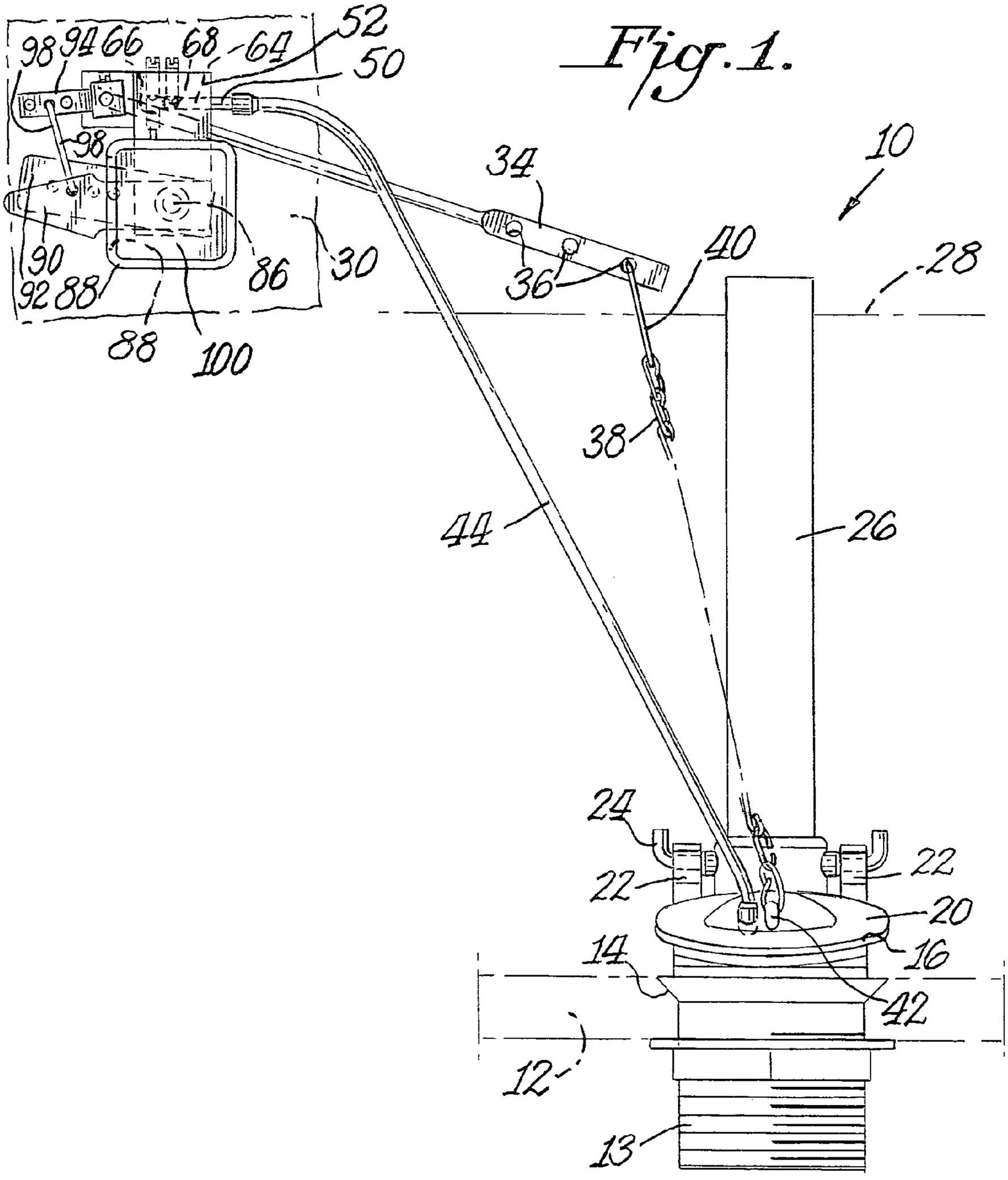


Fig. 1.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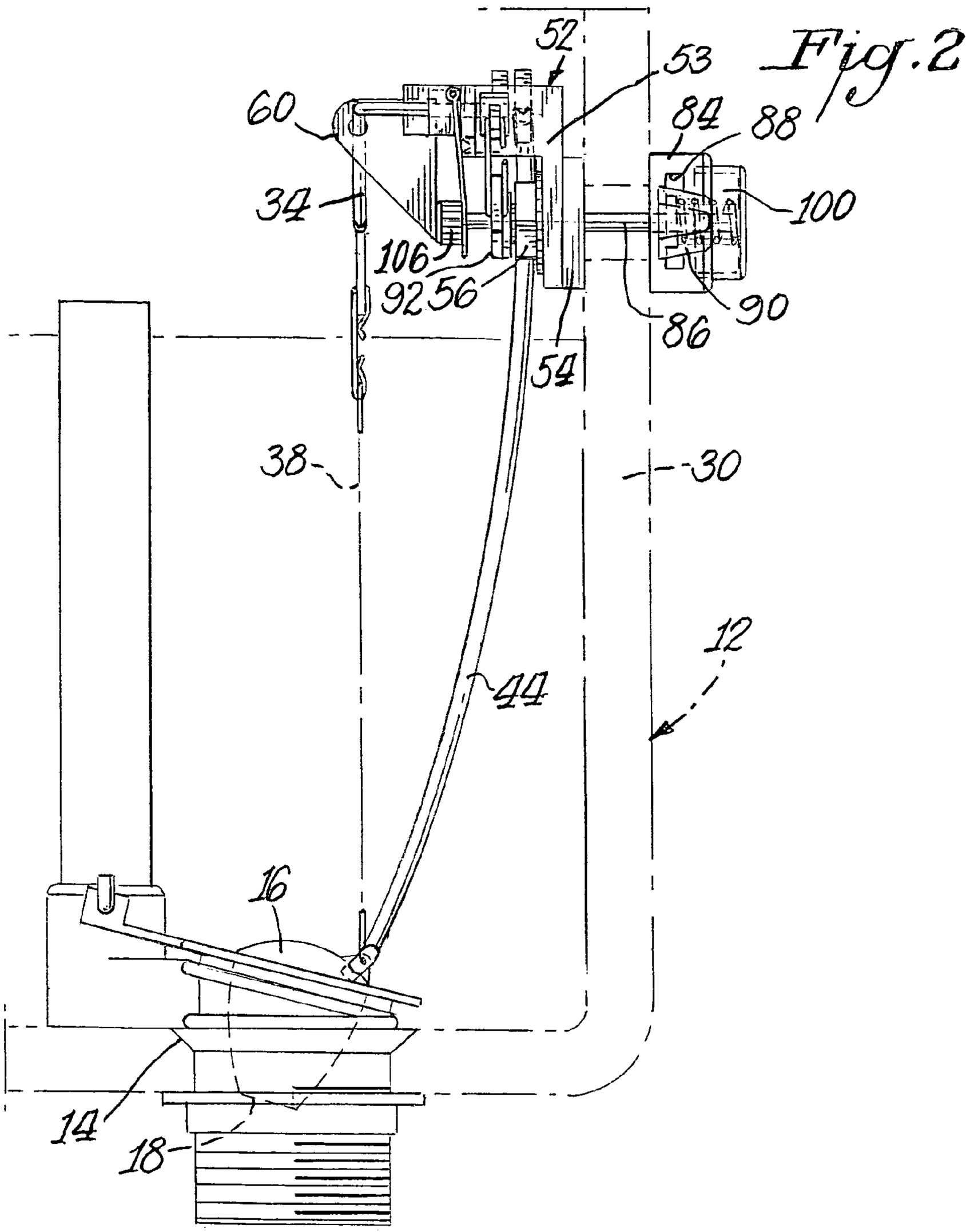


Fig. 2

Fig. 3.

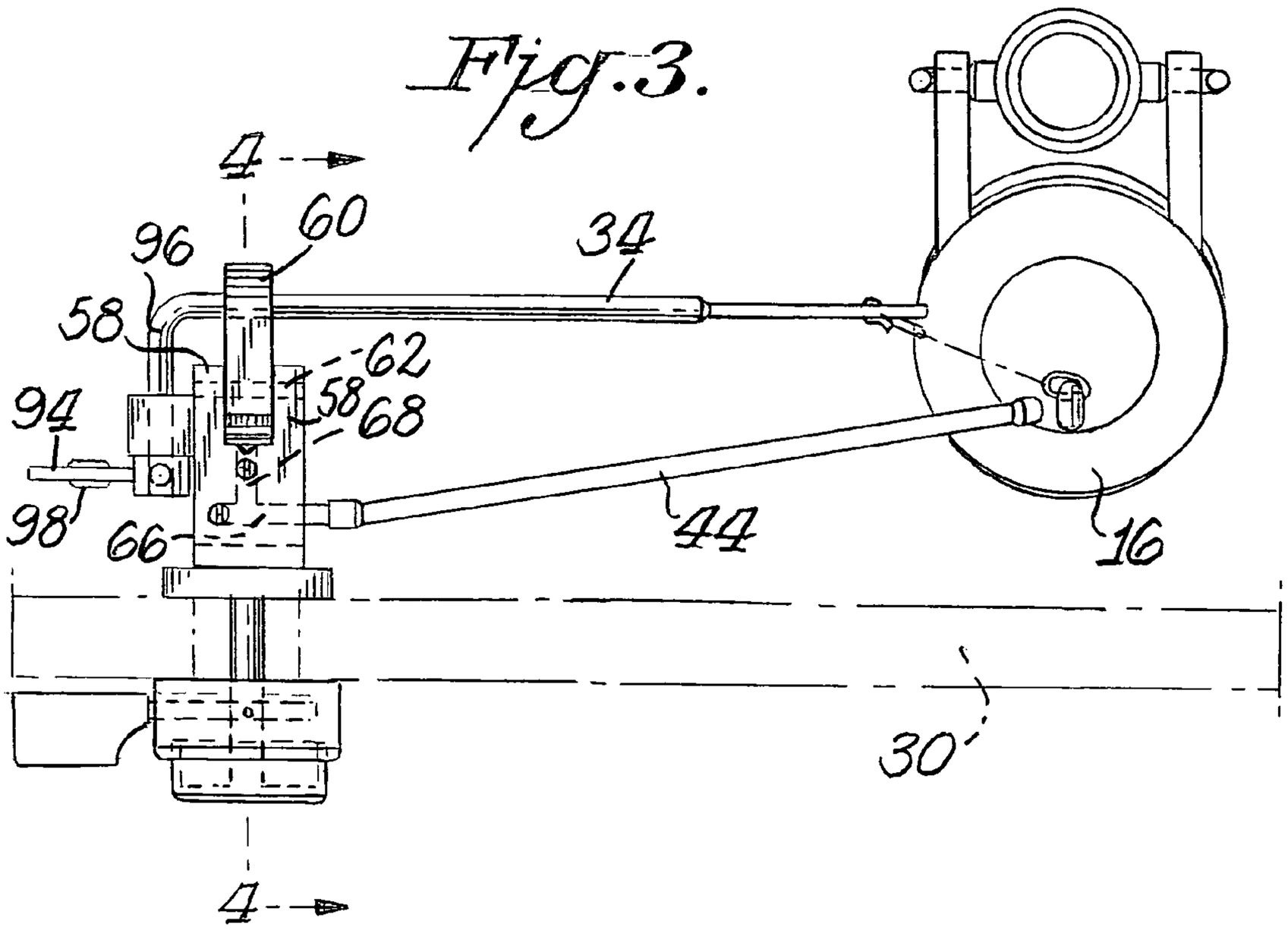
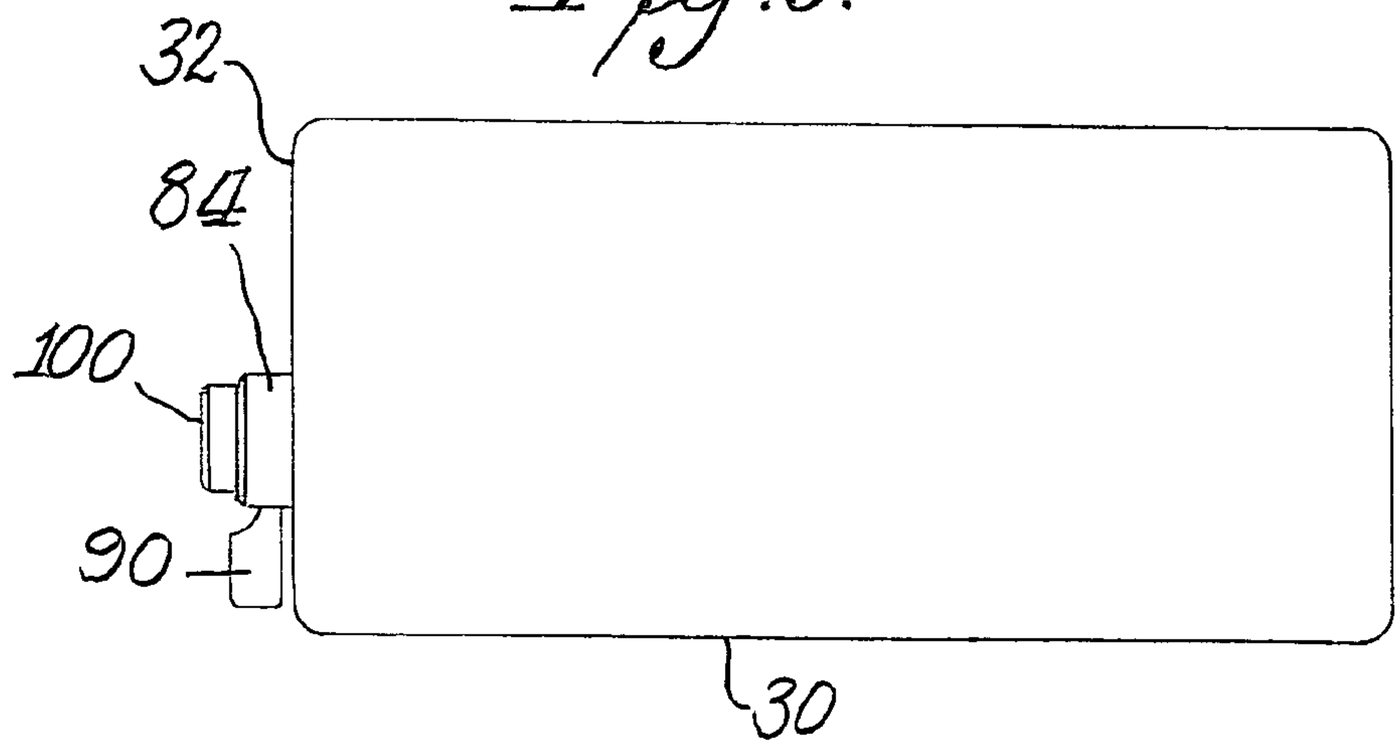


Fig. 6.



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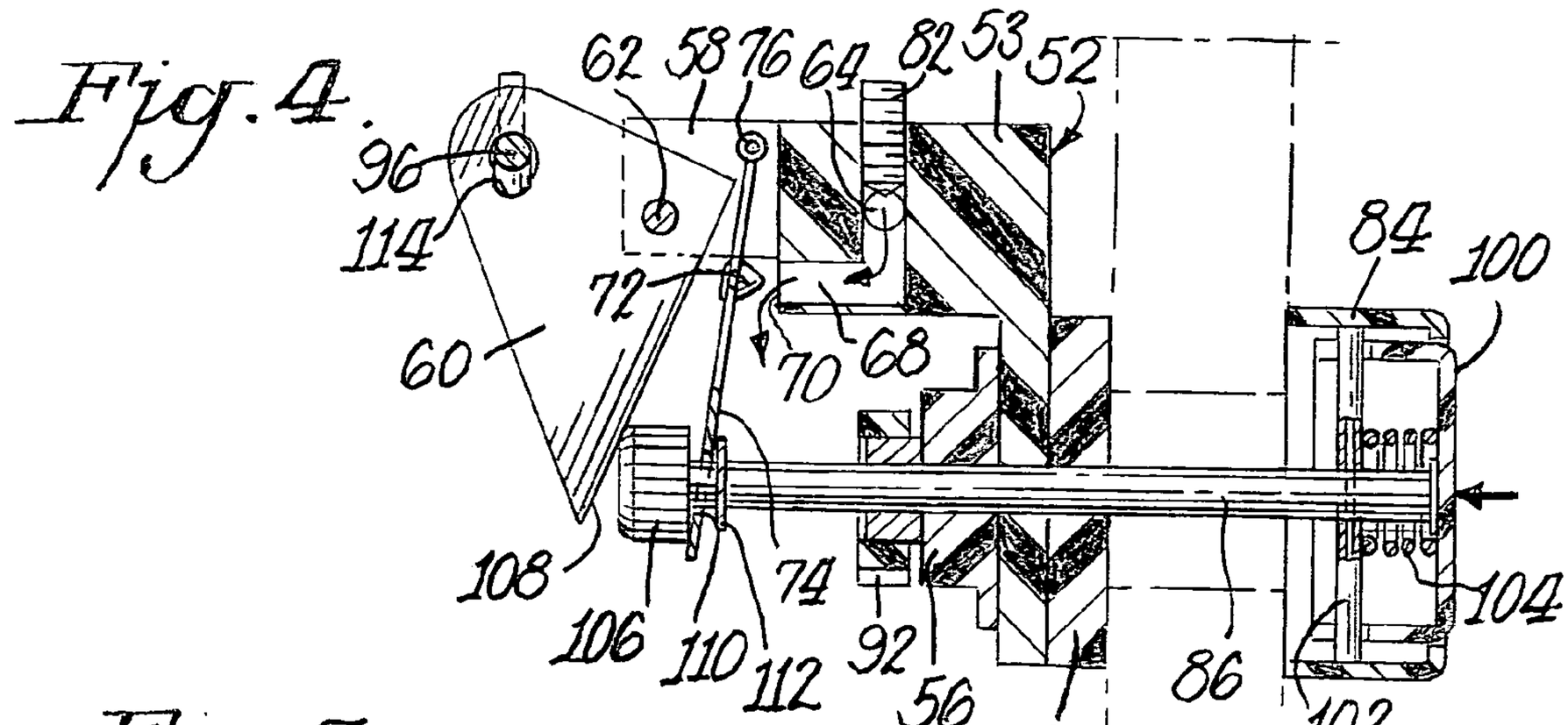

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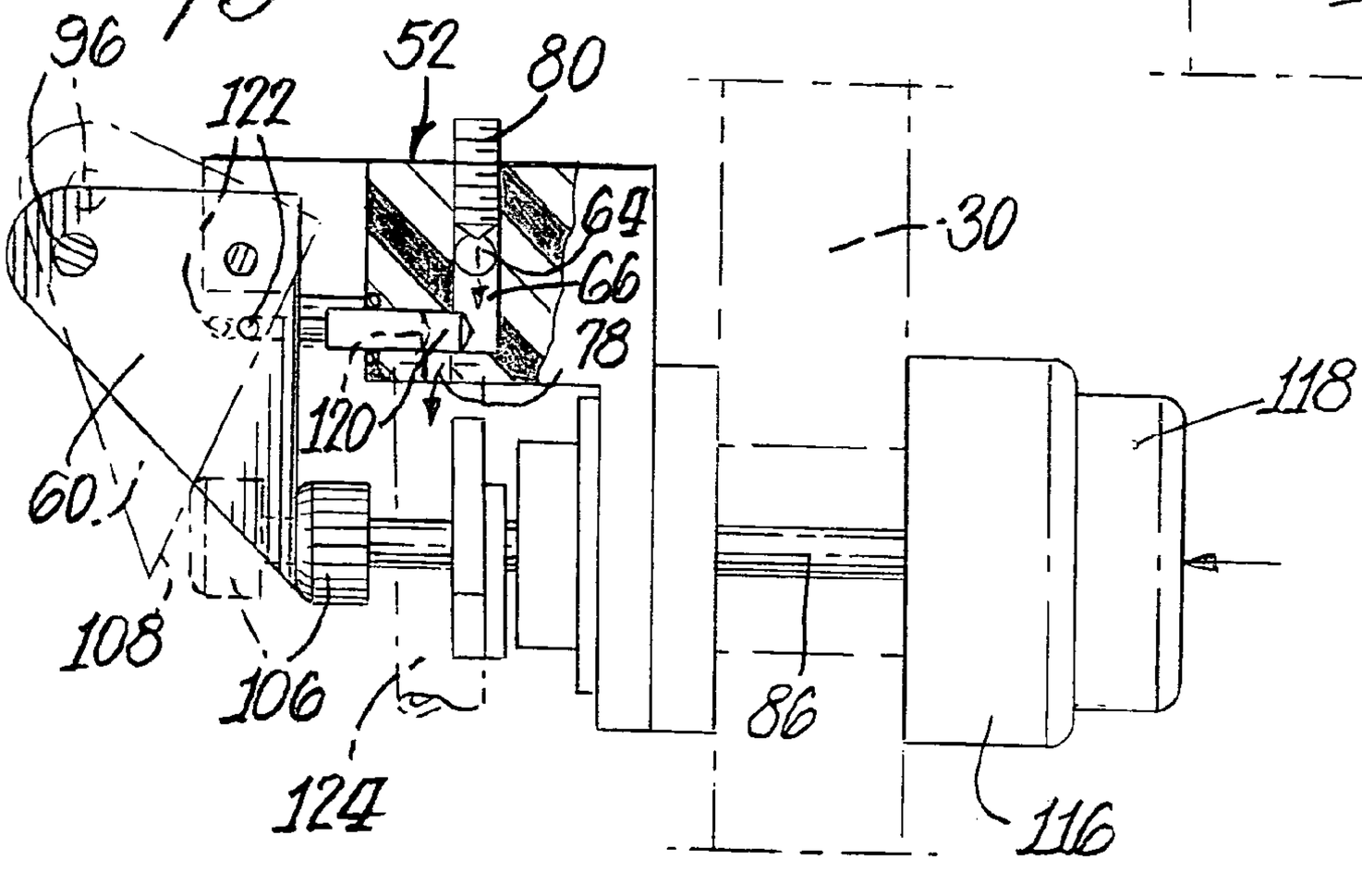

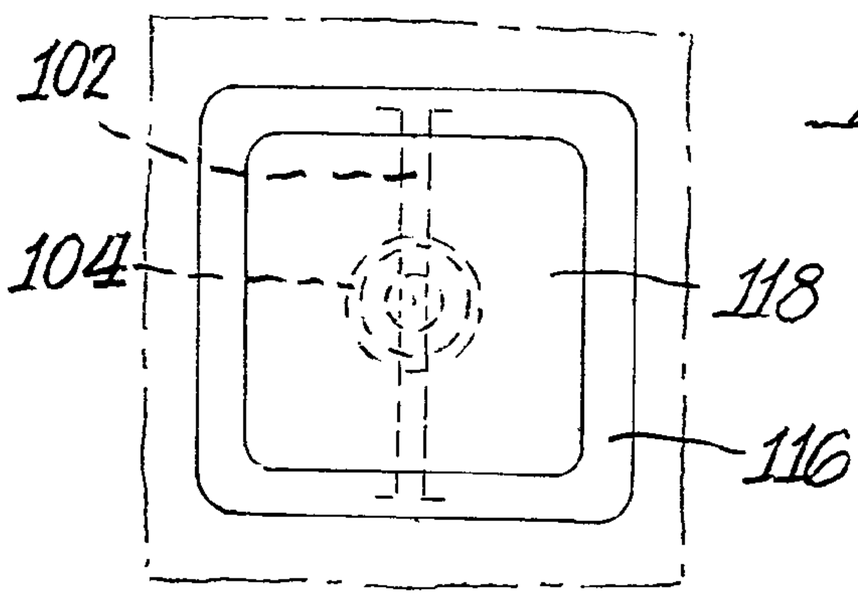

Fig. 8.

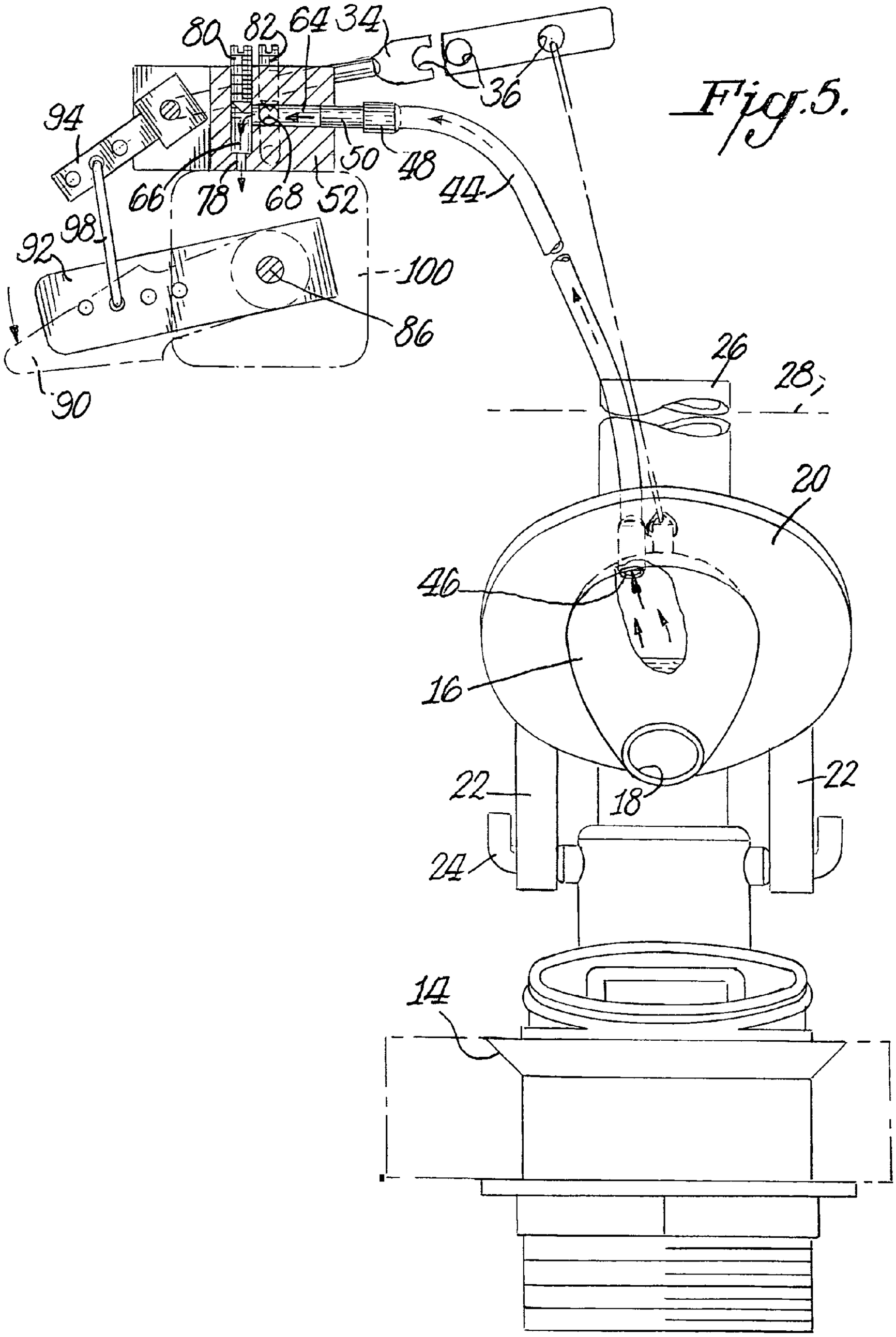
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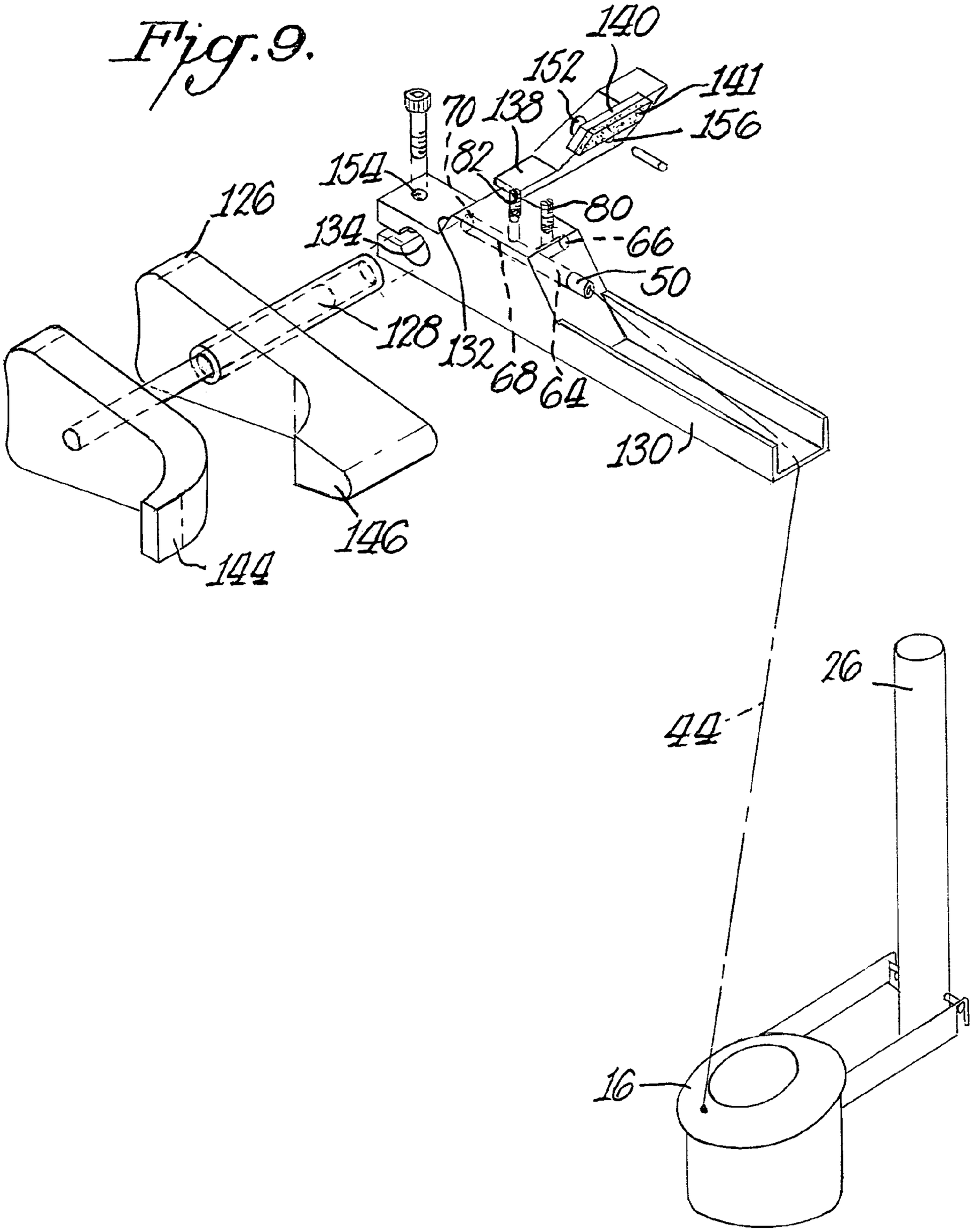
Fig. 5.

Fig. 9.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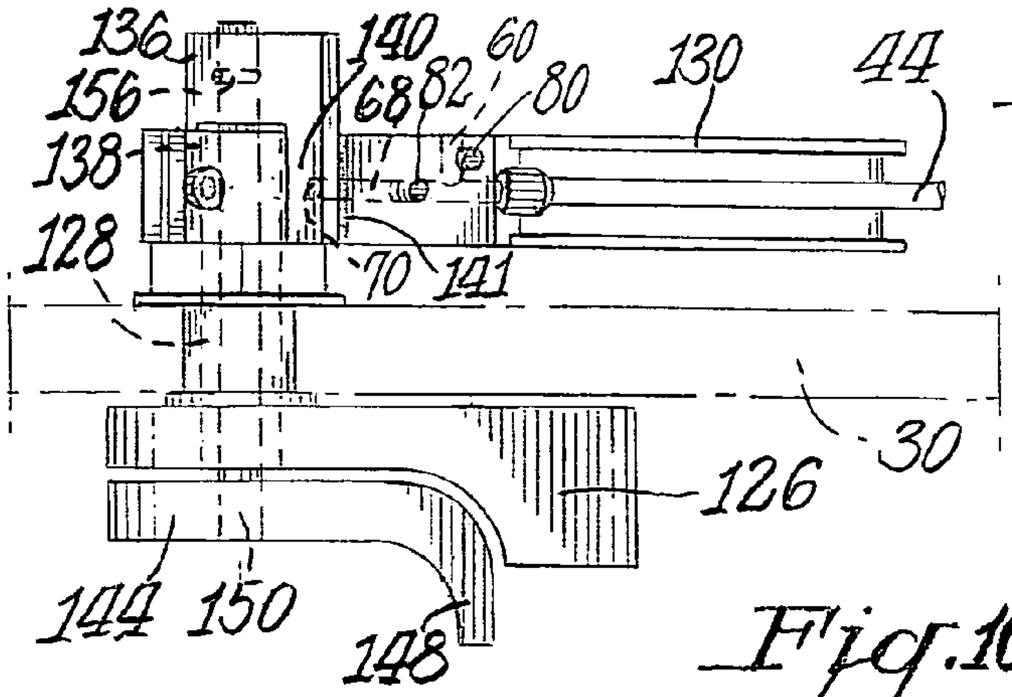

Fig. 12.

Fig. 10

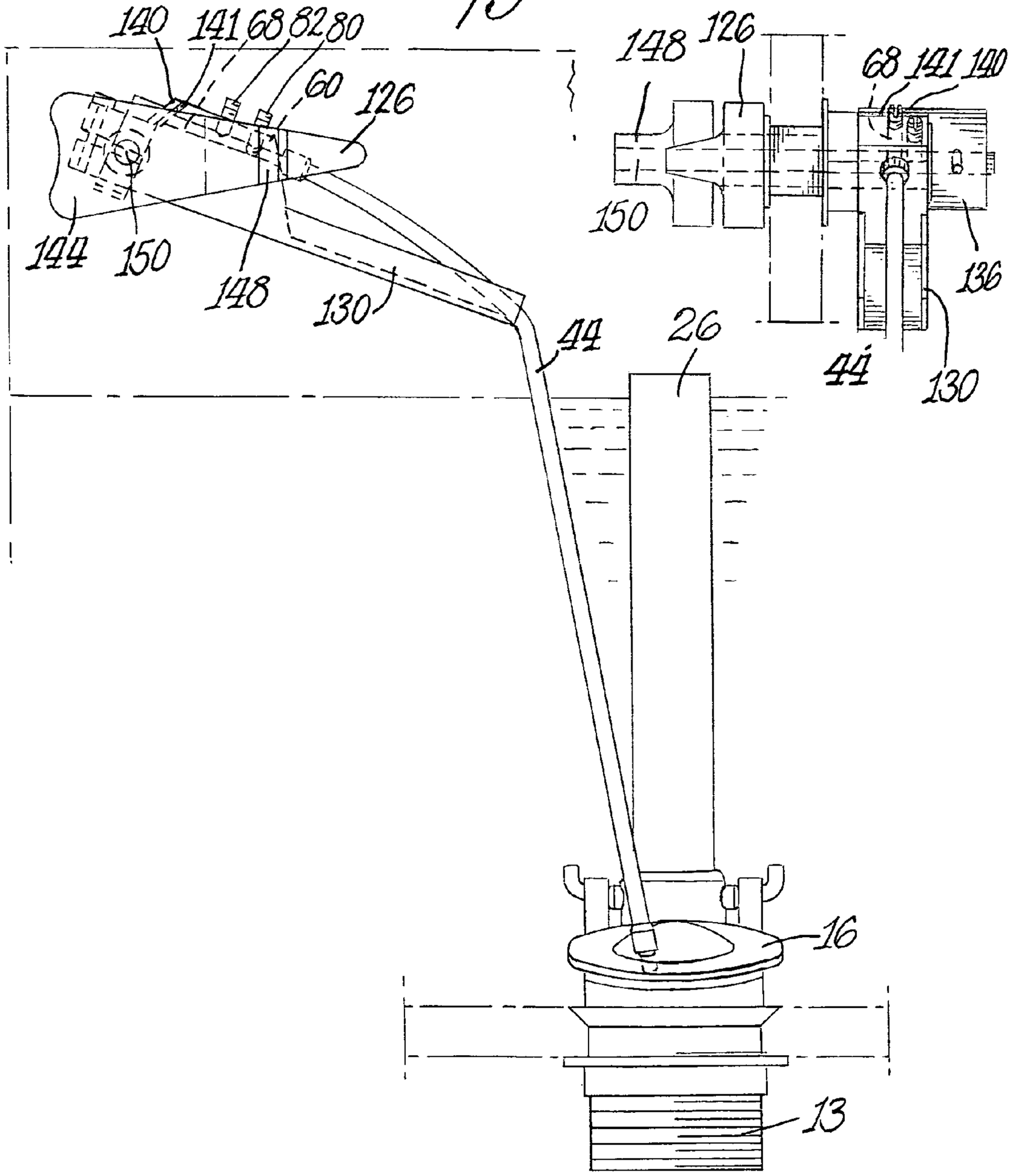

Fig. 11.

Fig. 13.

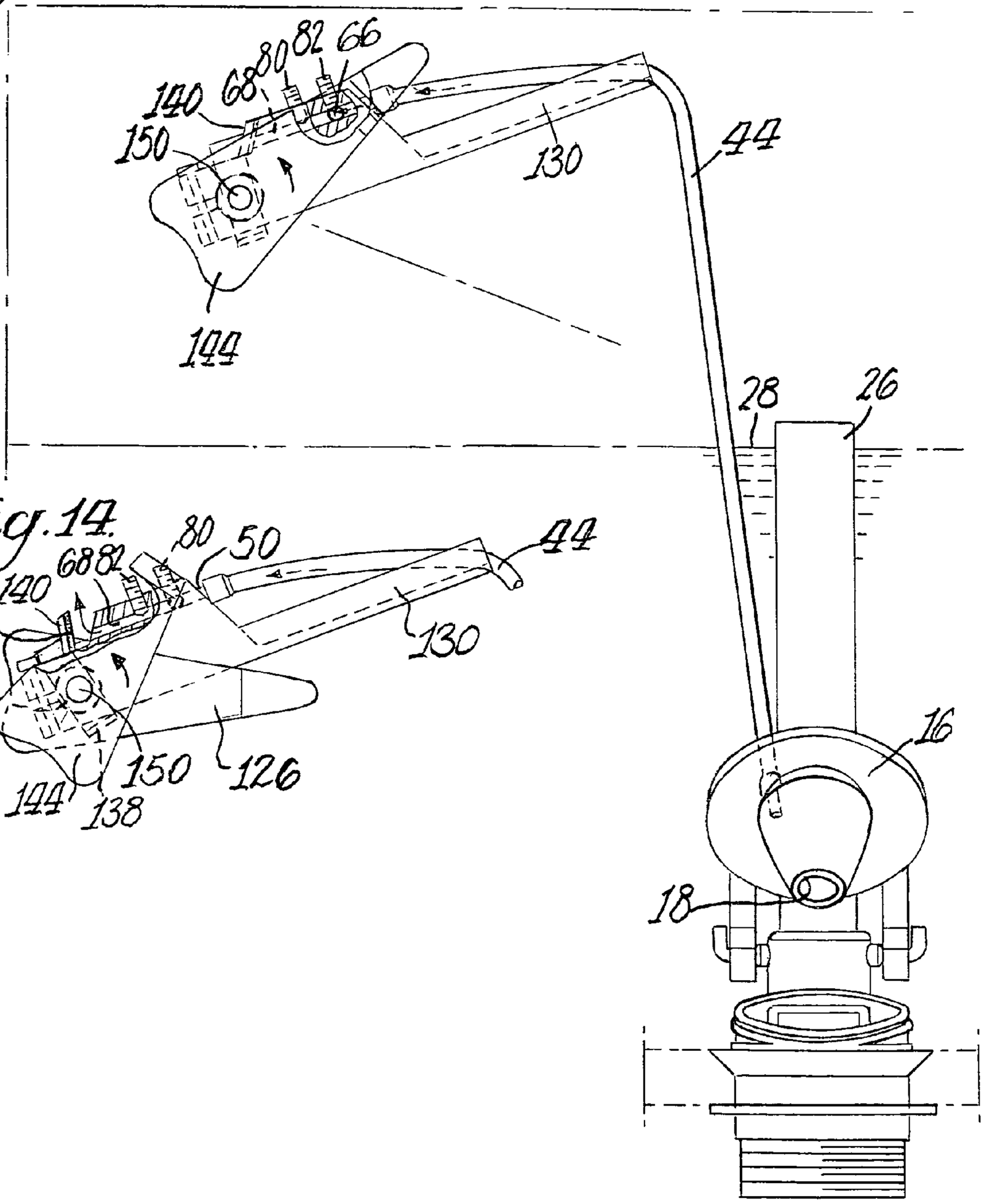
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Fig. 14.

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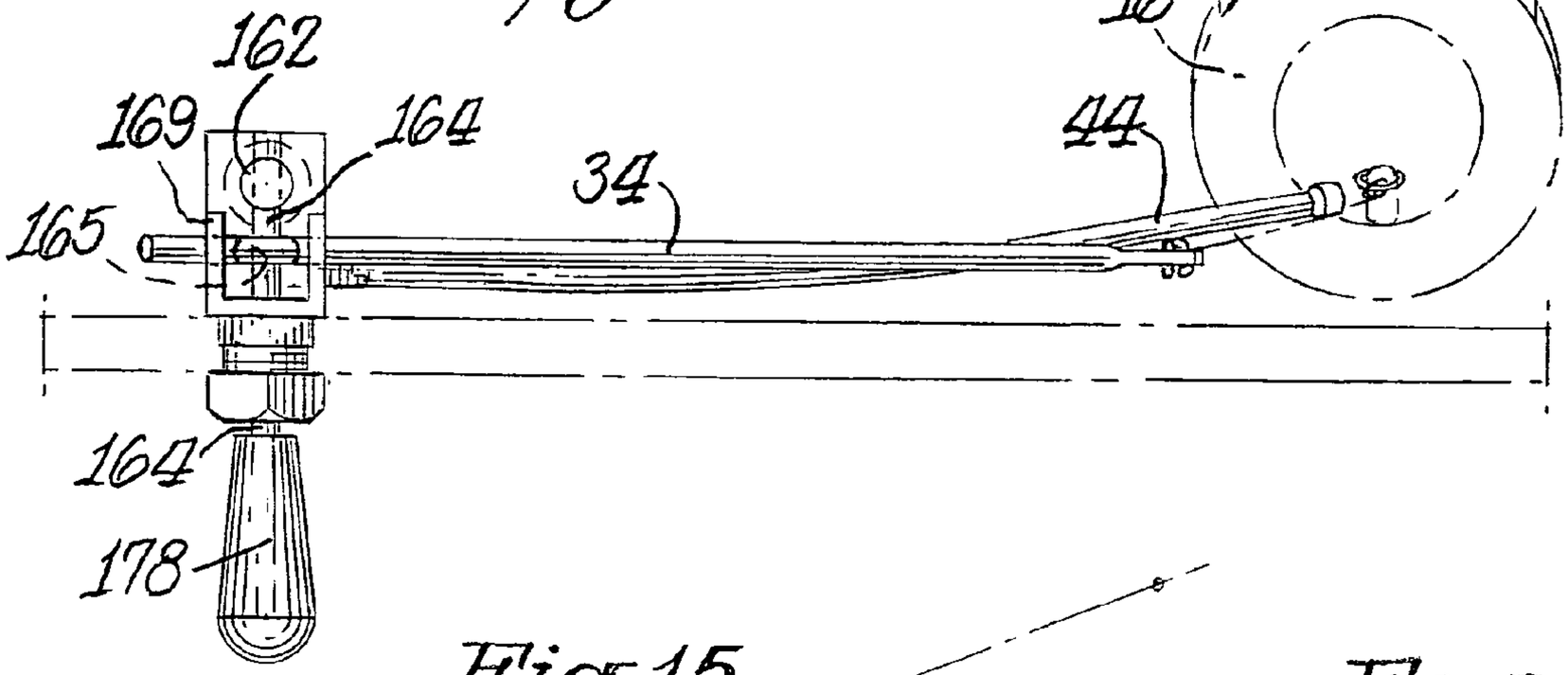
Fig. 16.



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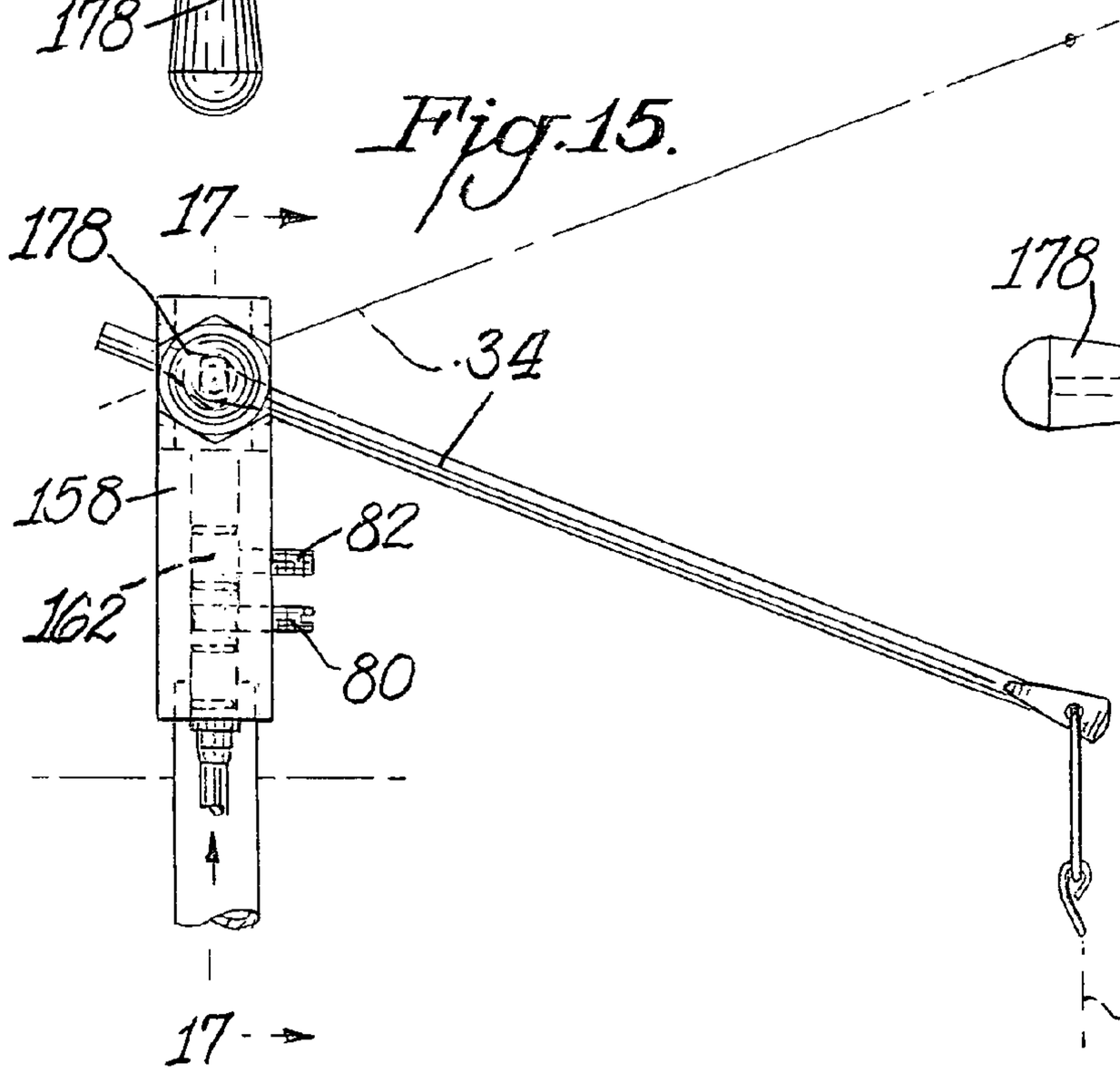

Fig. 17.

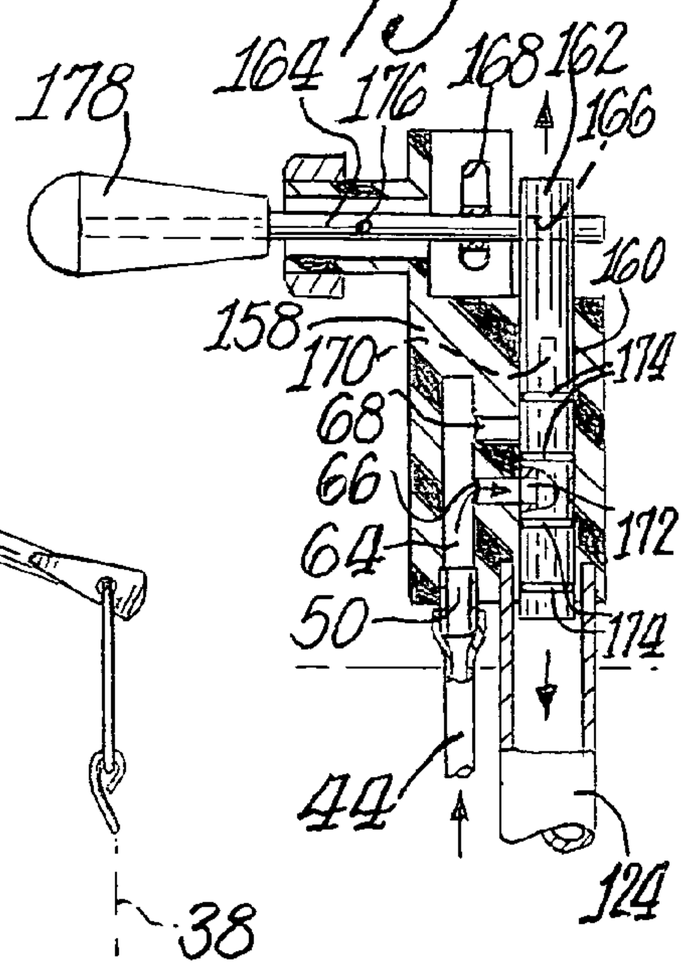

Fig. 18

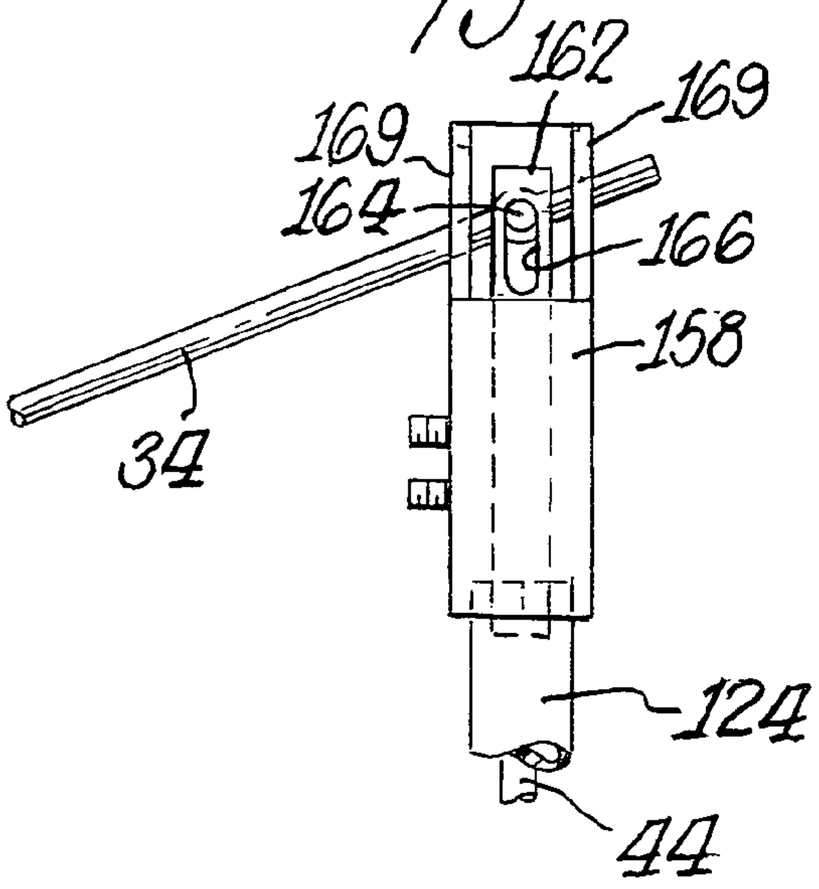
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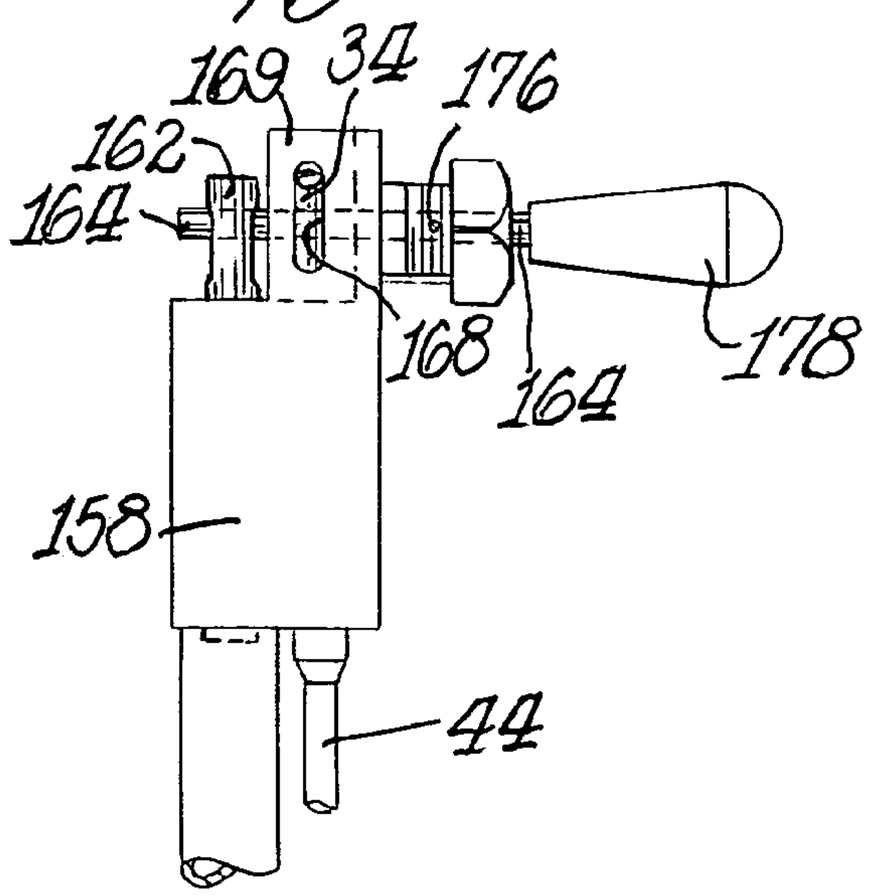
Fig. 19.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TWO-STAGED TOILED TANK BOWL CONTROL SYSTEM

BACKGROUND OF THE INVENTION

There is a growing consciousness of the need to conserve water, particularly in toilets where it is not always necessary to have a full flushing of the toilet. In order to conserve flushing water, attempts have been made at providing two step flushing control type systems wherein there are two flushing modes. One of the modes is a full discharge flushing and the other is a water saving or partial flushing mode.

Typical toilets include a flush handle mounted on the outside of the tank. When the handle is manually pressed a valve, such as a flapper valve, is lifted from the valve seat. The flapper valve includes an inverted air chamber so that it initially floats as it is lifted away from the valve seat or drain outlet. This floating flapper valve permits water to flow into the bowl even if the user immediately releases the flush handle. As the body of water flows through the drain outlet of the tank it starts the syphoning action in the bowl and flushes the standing water in the bowl along with its waste contents into the sewer line. When the tank is nearly empty the flapper valve closes and the tank continues to fill as the float ball connected to the ball cock rises. At the same time water from the ball cock valve enters an overflow tube to refill the bowl to its normal water level and the bowl cock valve closes.

Because of water shortages, particularly those which periodically result in significant portions of the United States, there have been major conservation efforts including efforts directed to conventional toilets which are wasteful and inefficient since a relatively large quantity of water is used to accomplish every flush.

Patents directed toward dual flush operations are U.S. Pat. Nos. 6,704,945, 5,943,708 and 5,375,268.

SUMMARY OF THE INVENTION

An object of this invention is to provide a two-stage toilet tank bowl control system which permits a full flush and when desired a partial flush.

A further object of this invention is to provide such a control system wherein the selection of a full flush or a partial flush can be readily accomplished by the user.

In accordance with a preferred practice of this invention the two-stage toilet tank bowl control system includes a tank ball, such as a flapper valve, which is on the valve seat or drain outlet in the tank. An actuating system is mounted to a wall of the tank and includes a lifting member, such as a lever, connected to the tank ball by a transmission member, such as a chain, in a conventional manner so that the tank ball is removed from the seat when the lifting member is raised or moved in a flushing direction and the tank ball returns to the valve seat when the lifting member is moved in its downward or return direction. An air tube is mounted at one end to the hollow housing which forms the tank ball. The other end of the air tube is in flow communication with a passageway in an air flow block mounted to the tank wall as part of the actuating system. The passageway has a full flush branch with an outlet end and a partial flush branch with an outlet end, each of which leads to the outer surface of the block. A partial flush valve selectively opens and closes the outlet end of the partial flush branch. The actuating system also includes a handle assembly having a full flush or master handle structure which moves the tank ball off the valve seat so that air may flow from the ball housing through the passageway and the full flush branch and then out of the block while the partial flush valve continues to close air flow from the partial flush branch. The handle assembly also includes a partial flush or auxiliary handle structure which moves the tank ball off the valve seat to permit air to flow from the hollow housing of the tank ball through the passageway and through the partial flush branch and then out of the partial flush branch with the partial flush valve being moved to its open position. As a result air is more quickly purged from the tank ball and the tank ball returns more quickly to the valve seat. As a result, a lesser amount of water is used with the partial flush than with the full flush.

In a preferred practice of this invention the full flush handle structure may be a pivoted lever type master handle while the partial flush structure may be an inwardly moving push button auxiliary handle. The full flush lever handle is mounted to a shaft which extends through and is connected to a link which in turn is connected to an extension of the lifting lever. As a result, when the full flush handle is rotated, the shaft is also rotated to rotate the link and thereby also rotate the lifting lever in its flushing direction so that the tank ball is removed from the valve seat. The partial flush handle or button is also connected to the shaft and can be moved inwardly. The shaft terminates in a pushing member abutting against a pivoted actuator. The lifting lever is inserted through a hole in the actuator so that rotation of the actuator causes the lifting lever to rotate in an upward direction for unseating the tank ball. A carrier, such as a leaf spring or plate on the shaft is pivotally mounted to the block and carries the partial flow valve. When the shaft is moved inwardly by pushing the partial flow push button handle the carrier is also moved inwardly to withdraw the valve from closing the outlet of the partial flow branch of the passageway so that air can flow through the passageway and exit from the bypass branch more quickly than the air would exit where only the full flow branch is used thereby closing the tank ball more quickly than when actuated by the full flush or master handle.

Various other alternatives are described for opening and closing the partial flow branch of the passageway and for forming the full flush and partial flush handle structure.

THE DRAWINGS

FIG. **1** is a fragmental elevational view of a two-stage toilet tank bowl control system in accordance with this invention;

FIG. **2** is a left side elevational view of the system shown in FIG. **1**;

FIG. **3** is a top plan view of the system shown in FIGS. **1**–**2**;

FIG. **4** is a fragmental cross-sectional view in elevation taken through FIG. **3** along the line **4**—**4**;

FIG. **5** is a view similar to FIG. **1** showing the system in a further phase of operation;

FIG. **6** is a top plan view showing the general shape of a tank with a system similar to that of FIGS. **1**–**5** mounted on a different wall of the tank;

FIG. **7** is a fragmental cross-sectional view in elevation showing a further embodiment of this invention;

FIG. **8** is a fragmental front elevational view of the embodiment shown in FIG. **7**;

FIG. **9** is an exploded view of a further embodiment of this invention;

FIG. **10** is a side elevational view of the system shown in the system of FIG. **9**;

FIG. **11** is a right side elevational view of the system shown in FIGS. **9**–**10**;

FIG. **12** is a top plan view of the system shown in FIGS. **9**–**11**;

FIG. **13** is a side elevational view similar to FIG. **10** in a different phase of operation;

FIG. **14** is a side elevational view of the handle structure shown in FIG. **10** in a different phase of operation;

FIG. **15** is a front elevational view of still yet another system in accordance with this invention;

FIG. **16** is a top plan view of the system shown in FIG. **15**;

FIG. **17** is a cross-sectional view taken through FIG. **15** along the line **17**—**17**; and

FIGS. **18**–**19** are rear and side elevational views of the system shown in FIGS. **15**–**17**.

DETAILED DESCRIPTION

FIGS. **1**–**5** show one embodiment of this invention relating to a two-stage toilet tank bowl control system **10**. As shown therein system **10** would be used in conjunction with a conventional water tank **12** of a toilet. Within the water tank is a drain **13** having a valve seat **14** which is selectively opened and closed by a tank ball **16** which could be of flapper valve type construction. Generally, as shown in FIG. **5**, ball **16** is in the form of a hollow housing having an open end **18** which is inserted into the drain until the outwardly tapered arcuate sides of the housing seat against and close the drain. A circular rim **20** is located outwardly of the housing in the upper area of the housing. A pair of arms **22** are provided on each side of the ball **16** hinged to extensions **24** of overflow tube **26** in a known manner. When the ball **16** is lifted away from seat **14** as shown, for example, in FIG. **5** the drain is exposed and water flows downwardly through the drain past seat **14**. When the ball is in its closed position shown in FIG. **1** water can not escape through the drain. FIGS. **1** and **5** illustrate the water level by the reference numeral **28**.

System **10** includes an actuating system for controlling the flushing operation. The actuating system is suitably mounted to a wall of tank **12** such as to the front wall **30** as illustrated in FIGS. **1**–**5**.

The actuating system includes a lifting member such as a lever **34** of known construction. Lever **34** would have a suitable number of holes **36** to provide a site of connection to the tank ball **16**. The connection is made by a transmission member which could be a chain **38** having a hook **40** at its upper end which is inserted into one of the holes **36**. The lower end of chain **38** would be secured to an attachment member **42** on the tank ball **16**. When lifting lever **34** is rotated in an upward or flushing direction such as shown in FIG. **5** the tank ball **16** is pivoted upwardly out of closing contact with seat **14**. When lever **34** is permitted to move in its return direction to the position shown in FIG. **1** tank ball **16** is permitted to pivot back into closing contact with seat **16**.

In accordance with this invention an air tube **44** is mounted to the top of tank ball **16** and communicates with the hollow interior or chamber of the tank ball as shown by the reference number **46** in FIG. **5**. The opposite end **48** of tube **44** fits on nipple **50** mounted to and extending from an air flow block **52** mounted to wall **30** of tank **12**. Air flow block **52** includes a number of components which could be integral with or separate from and then disposed against the main body portion. For example, as illustrated in FIGS. **2** and **4** the main body portion **53** of block **52** is of inverted L-shape and could be made of any suitable material such as

Delrin or other plastic. A spacer plate **54** is mounted directly against wall **30** and is secured to L-shaped member **53**. A further plate **56**, which could be a threaded nut, is mounted against the downward extension of member **53** as best shown in FIG. **4**.

As shown in FIGS. **3** and **4** the upper portion of member **53** is slotted to provide a pair of extensions **58**,**58**. A generally triangularly shape actuator **60** is pivotally mounted to these extensions by being inserted into the slot with a pivot pin **62** spanning the extensions **58**,**58** and extending through a hole in actuator **60** for purposes which will later be described.

As shown in FIG. **1** nipple **50** communicates with a flow passageway **64** so that air flowing from the interior of the hollow tank ball **16** can flow through tube **44** and into passageway **64**. Passageway **64** communicates with two branch passages. One branch passage **66** may be considered a full flush branch and is shown in FIG. **1** to extend vertically downwardly from passage **64** to the exposed surface of block **52**. See also FIG. **5**. The second branch passage **68** is best shown in FIG. **4**. As shown therein, branch passage **68** communicates with main passageway **64** and then leads to the outer surface of block **52** having its outlet end **70** on a vertical wall of the block. The outlet **70** serves as a seat which is opened and closed by a partial flush valve **72** mounted on resilient plate or spring member **74**. Valve **72** may be of any suitable construction. In the illustrated embodiment valve **72** is a resilient plug with a tapered, conical or circular outer surface. As illustrated in FIG. **4** a carrier such as a leaf spring plate **74** is pivoted at one end **76** to block member **53** in the slot formed between extensions **58**,**58** as will be later described.

Flow from the air tube **44** into passageway **64** may then exit from air flow block **52** through full flush branch **66** and/or through partial flush branch **68**. The outlet end **78** of full flush branch **66** is preferably always open. The branch, however, may be completely or partially closed and be of restricted flow capacity by manipulating a suitable valve, such as needle valve **80** as shown in FIG. **5**. Similarly, flow into and through partial flush branch **68** may be restricted or closed by manipulating a valve, such as needle valve **82** as shown in FIG. **4**. Flow control members, such as needle valves **80**,**82**, thus provide the ability to achieve fine tuned adjustment through branch **66**,**68** or any other flow passageways which could incorporate such flow control members.

The invention is based upon the recognition that when a tank ball is used, such as illustrated, air inside the ball tends to make the ball more buoyant which delays the ball returning to its valve seat closing position thereby prolonging the flush. If air is expunged from the ball, the air is displaced by water causing the ball to be less buoyant and resulting in a faster valve seating with a shorter flush. The use of air outlet tube **44** to permit the air to be quickly expunged by opening the outlet **70** of the partial flush branch **68** or to take longer to be expunged through only the full flush branch **66**. This provides the user with the option of a full flush (such as for solid waste) or a partial flush (such as for liquid waste). With conventional toilets there might be eight flush cycles in a day, for one solid waste flush and seven liquid waste flushes. This could result in the use of about 12.8 gallons of water for the eight full flushes. The ability to have seven partial flushes, as with the invention, could result in a water use reduction of 5.4 gallons per day.

The present invention includes the use of a handle assembly to control the flow of air being exhausted from the system. In the embodiment of FIGS. **1**–**5**, the handle assembly includes master handle structure and auxiliary handle

structure. This structure includes a hollow casing **84** secured to wall **30**. A shaft **86** extends through wall **30** and through air flow block **52**. On the other side of wall **30** shaft **86** extends into casing **84**. Casing **84** includes an elongated slot **88** through which a lever type master handle **90** extends with the shaft **86** extending through a opening in master handle **90**. Master handle **90** is operatively secured to shaft **86** in any suitable manner whereby the pivoting or rotation of handle **90** causes the shaft **86** to also rotate. The mounting is such however, that shaft **86** can move transversely through the opening in handle **90** without causing transverse movement of handle **90**. For example, shaft **86** could include a longitudinal groove into which a pin from handle **90** extends. Thus when handle **90** is rotated, the pin would cause the shaft to rotate. If shaft **86** is moved horizontally, the pin would simply slide in the shaft slot without resulting in any movement of the handle **90**.

As shown in FIGS. **1** and **5**, a lifting link **92** is fixedly mounted to shaft **86**. The lifting lever **34** is of generally L-shape as shown in FIG. **3** and extends through a hole in actuator **60** with its bent end **96** being mounted to an extension **94** directly above lifting link **92**. A rigid connecting member **98** is pivotally mounted in selective holes in lifting link **92** and lever extension **94** as best shown in FIG. **1** and FIG. **5**. Lifting link **92** and lever extension **94** are preferably coplanar in a vertical plane perpendicular to shaft **86**. The bent end **96** of lifting lever **34** is parallel to shaft **86**.

In operation, when master handle **90** is rotated downwardly, shaft **86** is also rotated downwardly causing lifting link **92** to rotate downwardly as shown by the arrow in FIG. **5**. The downward rotation of lifting link **92** causes lever extension **94** to also rotate downwardly which in turn however causes the lifting lever **34** to rotate upwardly as shown in FIG. **5** so that the tank ball **16** is raised away from seat **14** permitting water to drain and forcing air through tube **44** as previously described and as shown by the arrows.

As shown in FIGS. **2** and **4**, shaft **86** extends through an opening in carrier **74**. When shaft **86** merely rotates as during the flushing by using master handle **90**, the carrier **74** remains stationary abutting against pusher **106** at the end of shaft **86**. Valve **72** carried by carrier **74** remains in its closing position against outlet **70** of partial flush branch **68** in the conditions shown in FIG. **2**. Accordingly, the air flow from tube **44** exits solely through full flush branch **66** and there is a full flushing of the toilet which would be desired particularly when solid waste is being flushed.

The system **10** also includes auxiliary handle structure which is illustrated as comprising a push button **100** slidably mounted in the open end of casing **84** as best shown in FIG. **4**. Push button **100** is mounted against the outer end of shaft **86**. Shaft **86** includes stop pins **102**. A spring **104** is mounted against push button **100** and stop pins **102** to urge push button **100** in its outwardly extended or non-use condition which is shown in FIG. **2** in a direction opposite the arrows shown in FIG. **4**. When push button **100** is pressed inwardly, as shown in FIG. **4**, the shaft **86** is forced inwardly sliding through the opening in master handle **90**. The opposite end of shaft **86** carries a pusher member **106** disposed against a wall **108** of actuator **60**. Shaft **86** fits snugly in hole **110** of carrier or spring plate **74**. Shaft **86** also carries a stop or abutment member **112** as shown in FIG. **4**. In the condition shown in FIG. **2** abutment **112** is located in a recess in link **94**. Abutment **112** limits the outward movement of shaft **86**. During the inward movement the snug fitting of shaft **86** in hole **112** of spring plate **74** causes the spring plate **74** to pivot about its pivot pin **76** carrying valve **72** with it, to open the outlet **70** of partial flush branch **68**, as shown in FIG. **4**. As further assurance, if the movement of shaft **86** is not sufficient to pivot spring plate **74**, abutment **112** will contact spring plate **74** to assure the movement of valve **72** to its open position. Conversely, abutment **112** prevents plate **74** from returning to a valve closing position by preventing the spring plate from sliding backwards on shaft **86** toward link **92**. When in this open position shown in FIG. **4**, the air being exhausted from the hollow housing of tank ball **16** is exhausted more quickly than under the full flush condition because both branches **66** and **68** are open. This causes the tank ball to close more quickly than under full flush conditions thereby using less water for flushing such as when only liquid waste is being flushed. As a result there is a conservation in the use of water.

While the embodiment of FIGS. **1–5** have been described in connection with open and closed flow from, for example, either of the branches **66** and **68**. The open flow and the closed flow need not be a completely open or a completely closed flow but could be restricted flow such as by the manipulation of the needle valves **80** and **82**.

The two-stage toilet tank bowl control system thus offers the user the option of actuating the master handle **90** when full flush operation is desired or actuating the auxiliary handle **100** when partial flush operation is desired. Under conditions of partial flush operation, the system includes provisions for increasing the exhaustion of air from the tank ball **16** so that the tank ball **16** more quickly returns against the seat **14** to close off further flow of water through the drain **13** of the tank **12**. FIGS. **1–5** illustrate a preferred practice of the invention, other variations however could also be used as will be described with respect to other embodiments.

When push button or auxiliary handle **100** is pressed inwardly as shown by the arrow in FIG. **4**, shaft **86** is also moved inwardly forcing pusher **106** against side **108** of actuator **60**. As a result, actuator **60** pivots about pivot pin **62**. Because lifting lever **34** extends through actuator hole **114**, when actuator **60** is rotated upwardly or in a clockwise direction as shown in FIG. **4**, from the position originally shown in FIG. **2**, the engagement of the lever with the edges of hole **114** results in the lifting lever **34** being moved upwardly or in a counter-clockwise or flushing direction to lift tank ball **16** off seat **14**.

For the sake of illustration, FIGS. **1–5** show the system **10** to be mounted to a front wall **30** of tank **12**. The invention however could be practiced where the system is mounted to any other wall such as to a side wall **32** as shown in FIG. **6**.

FIGS. **7–8** show a further embodiment of this invention with regard to structure for effecting a full flush. As shown therein, the handle structure includes a casing **116** mounted to the wall **30** with a push button **118** slidably mounted in casing **116**, push button **118** is similar to push button **100**. In this embodiment, the system would include the shaft **86** having a pusher **106** at its remote end disposed against the wall **108** of actuator **60**, which is pivotably secured to air flow block **52**. A difference in this arrangement, however, is that the opening and closing of the full flow branch **66** is controlled by a piston **120** pivotably mounted at one end **122** to actuator **60** and slidably mounted in a passage communicating with branch **66** upstream from branch outlet **78**. In the position shown in solid piston **120** closes off outlet **78** to prevent air from leaving branch **66** through outlet **78**.

When push button **118** is moved inwardly in the direction of the arrow shown in FIG. **7**, the shaft **86** is moved toward the left causing pusher **106** to rotate actuator **60** from the position shown in solid to the position shown in phantom. When actuator **60** is rotated in this clockwise direction,

piston **120** is pulled from the position shown in solid which closes the outlet **78** from the main portion of branch **66** to the open position shown in phantom whereby the air flowing through the passageway **64** and into branch **66** may be discharged through outlet **78**.

If desired, a power assist evacuation tube **124** (shown in phantom) could be mounted to the support or air flow block **52** at outlet **78** to assist in purging the air from the tank ball. In that regard, power assist evacuation tube would be of sufficient length to extend below the water level so that some water is in power assist tube **124**. When the flushing operation takes place, the water flows outwardly from power assist tube **124** into the tank thereby creating a suction above the lowering level of water in tube **124**. (This is also shown in FIG. **17**.) The suction created in tube **124** assists in pulling the air through the system from the tank ball and the air tube and the various passageways. Although not illustrated, a power assist tube may also be mounted to outlet **78** in the embodiment of FIGS. **1–5**.

When push button **118** is pushed inwardly, shaft **86** also moves inwardly and pusher **106** causes actuator **60** to pivot from the position shown in solid to the position shown in phantom. This rotation of actuator **60** causes bent end **96** of the lifter lever to rotate thereby lifting the ball **16** from seat **14**, as previously described. The rotation of actuator **60** also causes piston **120** to be retracted and opens outlet **78** of branch **66**.

The flow rate of the air being discharged through outlet of branch **66** can be adjusted by manipulation of a valve such as needle valve **80**. In addition, the flow rate can be adjusted by controlling the throw or reciprocating movement of the piston **120**. These adjustments of flow rate will determine the amount of flush thus rendering the system capable of being a full flush with restricted flow rate and slow air evacuation or being a partial flush with a higher rate of air evacuation.

The push button type handle structure used as the master handle, shown in FIG. **7** could be used where the system incorporates solely a full flush system. Alternatively, the master handle structure could be used in conjunction with an auxiliary handle to effect a partial flow, for example, the full flush could result when push button **118** is pushed inwardly to a first position as described with regard to FIG. **7**. Continued pushing could result in the opening of the partial flush branch similar to what was described with regard to FIGS. **1–5** wherein a spring plate could be mounted on shaft **86** to open the outlet of a partial flush branch when shaft **86** has been pushed further inwardly by a continued pushing of the push button **118**.

FIGS. **9–14** show a further embodiment of this invention for providing the user with a two-stage control system. FIG. **9** shows various components of this system before assembly. As shown therein, the components include a master handle **126** which would be fixedly mounted to shaft **128** which extends through the tank wall. Handle **126** and shaft **128** thus jointly rotate. Shaft **128** in turn extends through lifting member or lever **130** so that when handle **126** is rotated the lever **130** also rotates. In this embodiment, the lifting lever **130** includes structure to function as the air flow block. Lever **130** includes a nipple **50** onto which the air tube **44** which would be mounted to communicate the passageway **64** having a full flush branch **66** and a partial flush branch **68**. Needle valves **80** and **82** or other suitable valves could adjust the flow through each of these branches. The partial flush branch outlet **70** is exposed at an inclined surface **132**. A longitudinal hole **134** extends completely through lifting lever **130** through which shaft **128** would be located and locked for joint rotation with lifting lever **130**.

The system shown in FIG. **9** also includes a flow control member **136** mounted against lifting lever **130**. Member **136** has a lower flat extension or lifting tab **138** and an inclined wall or valve tab **140** which acts as a valve when it is disposed against outlet **70** for closing the outlet. Valve tab **140** includes a resilient pad or gasket **141** for creating a seal around outlet **70** by pressing against the area of surface **132** where outlet **70** is located. A further difference of the embodiment of FIGS. **9–14** in comparison to the embodiment of FIGS. **1–5** is that the air tube **44** also functions as the transmission member instead of having a separate transmission member such as chain **38**. It is to be understood that the embodiment of FIGS. **1–5** may also utilize the air tube as the transmission member.

An auxiliary handle **144** is mounted outwardly of the master handle **126**. Handle **144** is of generally L-shaped fitting in a generally L-shaped recessed wall **146** of master handle **126**. The outer end **148** of auxiliary handle **144** extends outwardly away from master handle **126** as shown in FIG. **12**, so that the auxiliary handle is readily accessible to be rotated during its actuation operation. Similarly, by having master handle **126** extend laterally outwardly of auxiliary handle **144**, the master handle is readily accessible.

Auxiliary handle **144** is secured to shaft **150** which is of smaller diameter than shaft **128**. Shaft **128** is hollow or of tubular form so that shaft **150** can extend through and rotate independently of outer shaft **128**. Shaft **150** would ultimately be mounted in hole **152** of control member **136** so that rotation of auxiliary handle **144** causes inner shaft **150** to rotate and thereby also cause rotation of control member **136**. In this manner, valve member **140** could be moved away from outlet **70** of partial flush branch **68**.

Although full flush branch **66** is illustrated as being horizontal. The full flush branch could also be vertical and a power assist tube similar to tube **124** could be mounted at the outlet of the full flush branch **66**.

Full flush operation would be initiated by pushing downward on master handle **126**, thereby rotating outer shaft **128** and rotating lifting lever **130** which in turn raises the air line/transmission member **44** to raise the tank ball **16** off the flush valve seat. Adjustment of the full flush could be accomplished by rotating needle valve **80** toward or away from a valve seat within the branch **66** to increase or decrease the length of flush.

Partial flush operation is initiated by pushing down on auxiliary handle **144** rotating the inner shaft **150** and subsequently rotating the control member **136** to move valve **140** away from the valve seat or outlet **70** thereby allowing exhaust of air from the tank ball **16** through the passageway **64** and branch **68** causing the tank ball **16** to become less buoyant and return to the flush valve seat **14** before total evacuation of flush water from the tank. If branch **66** is open, air also exhausts through branch **66**. Simultaneously, as valve **140** rotates away from the outlet **70**, the tab or extension **138** contacts the bottom of lever **130** lifting the lever **130** which in turn raises the tank ball **16** off the flush valve seat by means of the connecting air tube **44**. Adjustment of partial flush needle valve **82** inwardly toward its valve seat in branch **68** increases the length of partial flush while adjustment away from the valve seat produces a shorter partial flush.

Outer shaft **128** could be locked to lever **130** in any suitable manner. For example, as illustrated, a fastener could be inserted through the hole **154** in the split end of lever **130** and extend into the lower portion of the split end after the

shaft **128** is in hole **134** to clamp the shaft **128** to the lever **130**. Similarly, shaft **150** could be locked to control member **136** by insertion of a fastener through hole **156** which would firmly press against shaft **150**.

FIGS. **15**–**19** show still yet another embodiment of this invention wherein the dual handle effect is created by a single handle member. As shown therein, many of the same components are included in this system and thus the same reference numerals are used for those components. One of the differences is that the air flow block **158** has a longitudinal passageway **160** into which a piston **162** is slidably mounted. Piston **162** is coupled to the end of a shaft **164** by shaft **164** extending through an elongated slot **166** in the upper end of piston **162** and movable in a vertical plane. Air flow block **158** also includes an elongated slot **168** through which the lever **34** extends.

Piston **162** has a longitudinal axial air duct **170** which communicates with a transverse or lateral air duct **172**. By moving piston **162** in or out, the transverse passageway **172** is selectively in communication with either the full flush branch **66**, as illustrated in FIG. **17**, or with the partial flush branch **68**. The outer surface of piston **162** is provided with a plurality of spaced O-rings **174** to provide a sealing arrangement during the sliding movement of piston **162** in opening or passage **160** and to create sufficient friction to maintain piston **162** in whatever vertical location it is placed.

FIG. **17** also shows the incorporation of a power assist tube **124** at the bottom of block **158** in communication with the axial passageway **170** of piston **162**.

Shaft **164** extends through a hole **165** in lifting lever **34** so that when lever **34** passes through the slots **168** in the walls **169** of block **158**, the shaft **164** is passing through the lever and into the slot **166** of piston **162**. Alternatively, the lifting lever could pass through a hole in the shaft to couple the lifting lever and shaft together.

As shown for example, in FIGS. **17** and **19**, a pivot pin **176** extends through block **158** and through shaft **164** so that the shaft **164** is pivotably mounted to block **158**. A handle **178** which is illustrated as being of teardrop shape, is mounted to shaft **164**.

FIG. **15** shows in solid lines the position of lifting lever **34** when the tank ball is engaged with the seat before there is any flushing. In that condition, piston **162** may have its lateral duct **172** out of registry with either of the branches **66** or **68** or preferably may be in registry with either branch. In operation, handle **178** would be pushed downwardly and would rotate shaft **164** about pivot pin **176** in a clockwise direction as shown in FIG. **19**. The rotation of handle **178** would cause the end of shaft **164** in the piston **162** to move upwardly in slot **166** of piston **162**. Because shaft **164** extends through a tight opening in lever **34**, lever **34** is caused to move in a counterclockwise direction in a vertical plane, as shown in phantom in FIG. **15**. FIG. **17** illustrates lateral duct **172** in flow communication with full flush branch **66**. Downward movement of handle **178** from its parked position causes the shaft **164** to raise piston **162** as shown by the arrow of FIG. **17**. As a result, lateral duct **172** in piston **162** communicates with partial flush branch **68** whereby the air flowing through tube **44** can enter passageway **64** and exit from block **158** through branch **68** into the longitudinal duct **170** of piston **168** and then into the pressure assist tube **124**. This causes a fairly quick removal of the air from the tank ball to result in a short or partial flush.

If a full flush is desired, handle **178** is moved upwardly from its normal parked position causing shaft **164** to lower piston **162** until its lateral duct **172** communicates with full flush branch **66** so that the air from tube **44** can then exit from passageway **64** through branch **68** into piston duct **170**. Full flush branch **68** would have lesser air flow capacity than partial flush branch **68**. As a result, there is a longer flush since more time is required to evacuate the air from the tank ball.

The piston **162** has two positions. Its lowermost position is the full flush position where duct **172** communicates with full flush branch **66** position. Its uppermost position would be the partial flush position where duct **172** communicates with partial flush branch **68**. In this position a solid portion of piston **162** is disposed at partial branch **68** acting as a valve to close branch **68**. Since full flush branch **66** has lesser flow capacity than partial flush branch **68**, the air is purged more quickly when piston **162** is in its partial flush position.

The embodiment of FIGS. **15**–**19** may be practiced in various manners where selective isolation of the partial flush branch and the full flush branch is achieved. Thus lateral duct **172** is selectively in communication with one of the branches and isolated from the other branch. This could be accomplished by raising handle **178** for partial flush and lowering handle **178** for full flush or alternatively by lowering handle **178** for partial flush and raising handle **178** for full flush. Flow adjusting structure such as needle valves **80**,**82** could be used in branches **66**,**68** as fine adjustment members or screws to select the desired flush duration. The manipulation of valves **80**,**82** makes it possible select which of the branches will be the partial or the full flush branch. For example, the flow could be adjusted by valves **80**,**82** where there is lesser flow capacity in branch **68** thereby making that branch the "full flush" branch.

It is to be understood that the invention can be practiced where features disclosed in one embodiment can be incorporated in other embodiments. Thus, for example, any of the embodiments may use the air tube as the transmission member instead of a separate member (e.g. chain). Similarly any embodiment may use a power assist evacuation tube. Different structures for the handles, lifting levers, air flow blocks, etc. may also be used in various embodiments.

What is claimed is:

1. A two stage toilet tank bowl control system comprising a water tank, a valve seat in said water tank, a tank ball selectively positioned on said valve seat for controlling the flow of water from said tank, a flush actuating system mounted to a wall of said tank, said actuating system including a lifting member, a transmission member connecting said lifting member to said tank ball for moving said tank ball off said seat when said lifting member is moved in a flushing direction and for permitting said tank ball to return to being seated on said valve seat when said lifting member is moved in a return direction, said tank ball comprising a hollow housing having an open end disposed toward said valve seat, an air outlet tube mounted at one end to said hollow housing in flow communication with the interior of said hollow housing, said actuating system including an air flow block containing a flow passageway having an inlet end, said passageway having a full flush branch with an outlet end and having a partial flush branch with an outlet end, each of said outlet ends leading to the outer surface of said block, said air tube having a second end in flow communication with said inlet end of said passageway, a partial flush valve selectively opening and closing flow of air from outlet end of said partial flush branch, a handle assembly, said handle assembly including master handle structure for moving said lifting member in its flushing direction to move said tank ball off said valve seat and

permit air to flow from said hollow housing through said passageway and through said full flush branch and out of said block while said partial flush valve closes said partial flush branch, and said handle assembly including auxiliary handle structure for moving said lifting member in its flushing direction to move said tank ball off said valve seat and to open said partial flush valve and permit air to flow from said hollow housing through said passageway and through said partial flush branch and out of said block with a lesser amount of water use than when said master handle structure is actuated.

2. The system of claim **1** wherein said air outlet tube also comprises said transmission member.

3. The system of claim **1** including a power assist tube in flow communication with said full flush branch and said partial flush branch for extending below the water level in said tank to create air suction at said full flush branch when water flows out of said power assist tube during the flushing operation.

4. The system of claim **1** including a flow control valve mounted at each of said full flush branch and said partial flush branch to control the amount of flow through each of said full flush branch and said partial flush branch.

5. The system of claim **1** wherein said lifting member is a pivoted lifting lever connected to said transmission member, and said handle assembly being connected to said lifting lever to cause said lifting lever to rotate in said flushing direction, and to rotate in said return direction.

6. The system of claim **5** wherein said master handle structure comprises a master handle in the form of a pivoted lever, and said auxiliary handle structure comprises a push button selectively movable toward and away from said wall of said tank.

7. The system of claim **6** wherein said actuating system includes a rotatable shaft extending through said air flow block, said master handle being coupled to said shaft to cause said shaft to rotate when said master handle is pivoted, said lifting lever being linked to said shaft whereby said lifting lever is rotated when said shaft is rotated, said auxiliary handle push button being mounted against said shaft to push said shaft longitudinally inwardly when said push button is pushed inwardly, a carrier mounted on said shaft, said partial flush valve being mounted on said carrier for movement away from said outlet of said partial flow branch when said shaft is moved inwardly, an actuator mounted to said air flow block and disposed against said shaft, and said lifting lever being coupled to said actuator to cause said lifting lever to pivot when said shaft pushes against said actuator.

8. The system of claim **7** including a lifting link mounted to said shaft and extending outwardly from said shaft for joint rotational movement with said shaft, and said lifting lever being coupled to said lifting link whereby said lifting lever is rotated when said lifting link and said shaft are rotated.

9. The system of claim **8** wherein said lifting lever is generally L-shaped having a main portion and having a bent end generally parallel to said shaft, said bent end being connected to an extension generally perpendicular to said shaft, said extension and said lifting link being generally coplanar, and said extension being coupled to said lifting link by a rigid connector pivotally mounted to both said extension and said lifting link.

10. The system of claim **8** wherein said carrier is a leaf spring pivoted at one end to said block, said leaf spring having a hole through which said shaft extends, said partial flush valve being mounted to said leaf spring at a position between said pivoted one end and said hole, and longitudinal movement of said shaft in response to the pushing of said push button causing said leaf spring to pivot at said pivoted one end to move said partial flush valve away from said outlet of said partial flush branch to permit the flow of air out of said outlet of said partial flush branch.

11. The system of claim **10** wherein said partial flush valve is a resilient plug having a tapered circular outer surface for selectively fitting in said outlet of said partial flush branch.

12. The system of claim **10** including a casing mounted to said wall of said tank, said casing having a peripheral side wall and an open face disposed remote from said tank wall, a slot extending through said peripheral side wall, said master handle extending through said slot and coupled to said shaft within said casing, said push button extending out of said open face of said casing and being telescopically mounted for movement into said casing in a direction generally perpendicular to said master handle, a stop pin on said shaft, and a spring mounted between said stop pin and said push button to urge said push button away from said pin in a non-flushing direction.

13. The system of claim **12** including a pusher member mounted to the end of said shaft remote from said push button, an abutment member mounted on said shaft, said carrier being located between said pusher member and said abutment member, and said abutment member being movable into contact with said lifting link to limit the outward movement of said shaft.

14. The system of claim **13** wherein said actuator has a wall disposed against and in contact with said pusher member, said actuator being pivotally mounted to said block, and said lifting lever extending through a hole in said actuator whereby said pusher member causes said actuator to rotate when said push button is pushed inwardly with the engagement of said lifting lever in said hole of said actuator causing said lifting lever to rotate in its flushing direction.

15. The system of claim **5** wherein said air flow block is mounted to and is part of said lifting lever, a control member mounted at said block, said control member having a valve tab which is disposed against said partial flush branch outlet, and said valve tab comprising said partial flush valve.

16. The system of claim **15** wherein said master handle structure is a master handle in the form of a master handle lever mounted on a shaft, said shaft extending through said lifting lever and being coupled to said lifting lever for rotating said lifting lever while said valve tab of said control member remains in closing contact with said partial flush branch outlet.

17. The system of claim **16** wherein said shaft comprises a hollow tubular outer shaft, said auxiliary handle structure being in the form of a pivoted auxiliary handle lever, an inner shaft telescopically mounted in said outer shaft and extending into engagement with said control member whereby rotation of said auxiliary handle lever causes said inner shaft and said control member to rotate, and rotation of said control member causes said valve tab to be removed from said partial flush branch outlet.

18. The system of claim **17** wherein said control member has a lifting tab disposed below said lifting lever, and rotation of said control member causes said lifting tab to rotate said lifting lever.

19. The system of claim **18** wherein said partial flush branch outlet is located on an inclined wall of said block, said valve tab of said control member being inclined and disposed at the same angle as said inclined wall to make

surface contact with said inclined wall, and said valve tab having a resilient seal around said outlet of said partial flush branch.

20. The system of claim **5** wherein said air flow block has a longitudinal passage extending completely therethrough, a piston slidably mounted in said longitudinal passage, said piston having a longitudinal air duct which is open at one end, a lateral air duct in said piston communicating with said longitudinal duct, said lateral duct being in selective communication with said full flush branch and said partial flush branch in accordance with the positioning of said piston in said longitudinal passage, said handle assembly being mounted to one end of a shaft, the other end of said shaft being engaged with said piston whereby movement of said handle member is transmitted through said shaft for the selective raising and lowering of said piston, and said lifting lever being mounted to said shaft.

21. The system of claim **20** wherein said shaft is pivotally mounted in a vertical plane for raising and lowering said lifting lever and for raising and lowering said piston, and said handle assembly comprising a single handle which is both said master handle structure and said auxiliary handle structure in accordance with the degree of pivoting of said shaft.

22. The system of claim **21** wherein said shaft and said lifting lever are disposed generally perpendicularly to each other and are coupled together by one of said shaft and said lifting lever extending through a hole in the other of said shaft and said lifting lever.

23. The system of claim **22** including sets of spaced sealing members on the outer surface of said piston to create a seal at spaced locations with respect to said outer surface of said piston against the inner surface of said longitudinal passage in said block, said piston being movable to an upward partial flush position to dispose said lateral duct in flow communication with said partial flush branch, and said piston being movable to a downward full flush position when said piston is lowered from said partial flow position with said lateral duct being in flow communication with said full flush branch when said outlet of said partial flush branch is closed by a solid portion of said piston being located at said partial flush branch outlet whereby said closed portion of said piston comprises said partial flush valve.

24. The system of claim **23** wherein said shaft extends through a slot in said piston to raise and lower said piston upon the rotation of said shaft in a vertical plane, said lifting lever extending through a slot in said block to permit said lifting lever to move in a vertical plane, and said shaft being pivotally mounted to said block.

25. A toilet tank bowl flushing system comprising a water tank, a valve seat in said water tank, a tank ball selectively positioned on said valve seat for controlling the flow of water from said tank, a lifting lever in said water tank, a transmission member connecting one end of said lifting lever to said tank ball for moving said tank ball off said valve seat when said lifting lever is rotated in a flushing direction and for permitting said tank ball to return to being seated on said valve seat and said lifting lever is rotated in a return direction, a support block mounted to a wall of said water tank, a shaft slidably mounted through said support block, a push button mounted against said shaft whereby the inward pushing of said push button causes said shaft to move inwardly, an actuator pivotally mounted to said support block and disposed against an end of said shaft whereby inward movement of said shaft causes said actuator to rotate, and said lifting lever being mounted through a hole in said actuator whereby rotation of said actuator in response to the inward movement of said shaft causes said lifting lever to be raised in said flushing direction.

26. The system of claim **25** wherein said tank ball comprises a hollow housing having an open end disposed toward said valve seat, an air outlet tube mounted at one end to said hollow housing in flow communication with a passageway in said support block, said passageway having an outlet end exposed at a wall of said block, a branch passage communicating with said passageway, a piston slidably mounted in said branch passage for selectively opening and closing of said outlet, and said piston being pivotally mounted to said actuator whereby rotation of said actuator upon the inward pushing of said push button and of said shaft causes said piston to move from a closed position to an open position whereby air may flow from said air tube through said passageway and out of said outlet.

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